

# Basic outlines of a new hypothesis on physical reality

R. Alvargonzález and L. S. Soto

*Facultad de Física, Universidad Complutense, Madrid, Spain*

(Dated: April 17, 2009)

The papers mentioned in the bibliography lead to this new hypothesis which constitutes a wide panorama of the physical reality. Its coherence and its simplicity are virtues that make interesting to gaze upon it.

We feel grateful to M. J. Sparnaay and to S. K. Lamoreaux whose measurements on zero-point radiation have been a strong link between our reasonings and the physical reality, and we also feel grateful to Timothy H. Boyer whose works on zero-point radiation have been a welcomed help.

## I. BASIC OUTLINES AT COSMOLOGICAL LEVEL (SEE [1] AND [2])

- 1.1) The Universe began with the breaking in of photons of high energy, contained within the 3-dimensional spherical surface  $w^2 + x^2 + y^2 + z^2 = (R_i)^2$ .
  - 1.2) Photons are “packets of energy” which are characterised by travelling at the same velocity,  $c$ , and possessing the same quantity of action,  $h$ . They are differentiated by their wavelengths,  $\lambda$ , and their energies,  $E_\lambda = hc/\lambda$ .
  - 1.3) The initial photons were distributed equally in every possible direction. As a result, the Universe has continued to expand at the speed of light in every direction, since its beginning at  $t = 0$ . Therefore, when a period of time  $t$  has elapsed from  $t = 0$ , the Universe is configured as the 3-dimensional spherical surface  $w^2 + x^2 + y^2 + z^2 = (R_i + ct)^2$ .
  - 1.4) The condition  $w^2 + x^2 + y^2 + z^2 = (R_i + ct)^2$  determines that every point of space is subjected to a tension, whose intensity  $E$  is directly related to the curvature of space  $1/(R_i + ct)$ . The value of  $E$  is therefore the same at any moment, for all points in space, and lessens equally at all of them with the passing of time.
  - 1.5) The constant increase in the radius of the Universe implies a constant reduction in  $E$ , and consequently, the existence of:
    - An energy flow, zero-point radiation, which is inherent to space, and consequently possesses a relativistically invariant spectrum. For this to be so, its photons must have trajectories distributed equally along all directions of space, and the abundance of the photons must be inversely proportional to the cubes of their wavelengths. The density of this energy flow is directly proportional to the cube of the curvature.
    - A centrifugal energy flow, whose intensity is directly proportional to the 4<sup>th</sup> power of the curvature.
  - 1.6) The wavelength of the most energetic photons of zero-point radiation is directly proportional to the length of the radius of the Universe, so that the density of the energy of that radiation in the Universe lessens in direct proportion to the cube of the radius, and the total amount of that energy remains constant as the length of the radius increases.
  - 1.7) Many of the initial photons mentioned in 1.2, become configured as elementary particles. They revolve round axes passing through their centres, and because of their configuration, do so in such a way as to possess a spin of  $\hbar/2$ , and a tangential velocity of  $c$  at all their points.
  - 1.8) The velocity of the photons,  $c$ , is an absolute ceiling which cannot be attained by elementary particles [6].
  - 1.9) Elementary particles can come together to form higher-order entities, atoms, which possess properties which go beyond those of their components. Atoms can come together in higher-order entities, molecules, which also possess properties which go beyond those of their components.
  - 1.10) The objects which we can perceive are made up to aggregations of very great numbers of atoms and molecules. The stars are enormous cosmic objects which emit light.
  - 1.11) The sun is a star, around which orbit many cosmic objects which are unable to emit light. The planets, including Earth, are the 9 largest of these.
  - 1.12) The galaxies are immense structures, made up to thousands of millions of stars. The sun is a star in the Milky Way, our galaxy. There are thousands of millions of other galaxies at distances of millions of light-years from ours.
  - 1.13) Within the Universe, whose radius is  $R_U = R_i + ct$ , we must distinguish between the Material Universe, whose radius is  $R_{U_m} < R_U$ , and within it, the Visible Universe, made up of those objects which we are able to observe or which we could become able to observe, since the velocity at which they are moving away, because of the expansion of the Material Universe, is less than that of light.
- The Visible Universe is therefore configured as a spherical dome on the 3-dimensional spherical surface  $w^2 + x^2 + y^2 + z^2 = (R_{U_m})^2$ , whose volume is:

$V_{U_v} = 2\pi R_{U_m}(\varphi - \sin \varphi \cos \varphi)$ , where  $\varphi$  is the angle between the radius which reaches the centre of the dome, and any of the radii which reach the lesser circumference which forms its base. The volume of the Visible Universe must therefore represent a fraction of the volume of the Material Universe of  $\frac{\varphi - \frac{1}{2} \sin^2 \varphi}{2\pi}$ .

- 1.14) The quasars are visible cosmic objects whose light reaches us from the area of the horizon of visibility, and their luminosity must have been that of complete galaxies, i.e. a luminosity of hundreds of thousands of millions of stars.

No quasars have been observed except in that area, which means that they are structures belonging to the beginnings of the Universe, and ceased to exist thousands of millions of years ago.

- 1.15) The configuration of the Universe as a 3-dimensional spherical surface implies that space is relative. On a 2-dimensional spherical surface, we could not distinguish any point by preference; its centre is outside it. The same is true for a 3-dimensional spherical surface.

The evidence for the “Big-Bang”, and the disappearance of the quasars implies that time is not relative, but that it had a beginning at  $t = 0$  and  $R_U = R_i$ . The configuration of the Universe as a spherical surface of radius  $R_U = R_i + ct$  implies that all its points lie at the same distance from its centre, and that the value of  $t$  is the same for all of them.

According to the Special Theory of Relativity, the laws of Physics are the same at all points of the Material Universe, which requires that the lapse of time between  $t = 0$  and  $t_m$ , the moment of generation of the last elementary particle from the initial photons, is relatively insignificant.

## II. BASIC OUTLINES AT QUANTIC LEVEL (SEE [3], [4] AND [6])

- 2.1) This paper uses the system of units  $(e, m_e, c)$ , in which the basic magnitudes are the quantum of electrical charge,  $e$ , the mass of the electron,  $m_e$ , and the speed of light,  $c$ . In this system, the unit of length is  $l_e = e^2 m_e^{-1} c^{-2}$ , and the unit of time is  $t_e = e^2 m_e^{-1} c^{-3}$ .

- 2.2) Photons, which are energy packets moving at the speed of light,  $c$ , following rectilinear trajectories and possessing the same quantity of action,  $h = (2\pi/\alpha) \frac{e^2}{c} = (2\pi/\alpha) m_e l_e^2 t_e^{-1}$ , are differentiated by their wavelengths  $\lambda_e$ , and their energies  $E_{\lambda_x} = hc/\lambda_x = (2\pi/\alpha) m_e c^2 \cdot \lambda_x^{-1}$ .

- 2.3) The substance of the photons undulates along cylindrical helices of length  $\lambda_x$  and radius  $R = \lambda_x/\alpha$ , which gives them a spin of  $s = \hbar$ . The wavelength of the photon whose energy is  $E_e = m_e c^2$  is  $\lambda_e = (2\pi/\alpha) l_e$ , and that of the photon of energy  $E_x = m_x c^2$  is  $\lambda_x = (2\pi/\alpha) \frac{l_e m_e}{m_x}$ .

- 2.4) The transformation of a photon into an elementary particle does not require any change in its substance. It remains the same energy packet, with a quantity of action  $h$  and wavelength  $\lambda$ , which, instead of moving in a straight line as part of a series of waves, turns round on itself around a sphere of radius  $\alpha\lambda/2\pi$ , thus becoming an separate entity, revolving with a spin of  $\hbar/2$  and tangential velocity  $c$  at all its points.

- 2.5) The basic characteristics of elementary particles are:

- Their mass,  $m_x = E_x \cdot c^{-2}$ , where  $E_x = h_c \lambda_x^{-1}$  is the energy of the photon of wavelength  $\lambda_x$ .
- Their radius,  $r_x = \alpha\lambda_x/2\pi$ , where  $\lambda_x$  is the wavelength of the photon whose energy is  $m_x c^2$ .
- Their spin  $\hbar/2$ , which derives from rotation around an axis passing through the centre of the particle.
- The equation  $m_x r_x = e^2 c^{-2}$ , which is the primordial quantic threshold as concerns elementary particles.

- 2.6) The centrifugal force inherent to the spin of elementary particles with a spin of  $\hbar/2$  gives rise to the electrostatic force.

- 2.7) The electron is that elementary particle in which the centrifugal force inherent to its spin is equal to the centripetal force generated by its interactions with zero-point radiation.

- 2.8) The equation  $m_x r_x = e^2 c^{-2}$  requires that there cannot exist elementary particles with a spin of  $\hbar/2$  and a mass less than that of the electron, nor with a radius greater than that of the electron,  $r_e = 1l_e$ .

- 2.9) The centrifugal force of the particles of mass  $m_x > m_e$  is equal to

$$\frac{m_x(m_e)}{r_x(l_e)} \cdot c = m_x^2 \frac{m_e l_e}{t_e^2}.$$

In other words, it is equal to that of the electron multiplied by  $(m_x/m_e)^2$ . The surface of such a particle is equal to  $4\pi(r_x)^2$ , i. e.  $(m_e/m_x)^2$  times that of the electron, and therefore the centripetal force which derives from its interactions with zero-point radiation is  $(m_e/m_x)^{-4}$  times that of the said centrifugal force.

In the case of the proton,  $m_x = 1836m_e$ , and the centripetal force on the surface of the particle is

$1.1363 \times 10^{13}$  times less than the centrifugal force. The enormous imbalance between the centrifugal and centripetal forces causes the appearance of the energy flows required to balance them. These energy flows possess, at a distance of  $1l_e$  from the centre of the particle, an intensity per  $l_e^2$  of  $m_x l_e^2 t_e^{-2}$  per  $t_e$ , and at distance of  $1l_x = l_e m_e (m_x)^{-1}$ , they have an intensity of  $m_x^2 l_e^2 t_e^{-2}$  per  $l_e^2$  per  $t_e$ . In other words, they decrease in proportion to the distance to the centre, and not in proportion to the square of that distance. This is due to the interferences inherent to the small size of the angles between the flows which fall on adjacent points, and to the shortness of the distance between those points.

At distances from the centre which are greater than  $1l_e$ , the intensity of these flows decreases according to their squares.

- 2.10) Keeping in mind what we have explained in 2.7, we see that the energy flows aroused in order to balance out the centripetal and centrifugal forces on the surface of particles of mass  $m_x > m_e$  cause an apparent attraction between two such particles, which is equal to the gravitational attraction between them. In the case of electrons, where there is no reason for such energy flows to arise, the apparent attraction derives from the interactions of the particle with zero-point radiation [6].
- 2.11) Again remembering what we have explained in 2.7, we realise that the forces of repulsion inherent to the mutual electrostatic rejection between protons, and the energy flows caused by the imbalance between the centripetal and the centrifugal forces at the surfaces of protons and neutrons, balance each other out within the atomic nucleus, when the number of protons is approximately equal to the number of neutrons, and the masses of both protons and neutrons are very approximately equal to  $1851m_e$ . This explains the cohesion of atomic nuclei, the characteristics of protons, and the strong interaction [6].
- 2.12) Neutrinos are particles which possess a mass very much smaller than that of electrons, and have spin  $1/2$  and no charge.

### III. BASIC FORCES (SEE [3], [5] AND [6])

- 3.1) The interaction of zero-point radiation with elementary particles can give rise to:

- Forces of apparent attraction between any two particles, which are directly proportional to the products of their masses

$$\left( m_x = \frac{\alpha \hbar c}{2\pi r_x} \cdot \frac{1}{c^2} \right),$$

and inversely proportional to the squares of the distance between them:

$$f_G = \frac{m_x m_y}{(d_{xy})^2} \cdot G,$$

where  $f_G$  = gravitational attraction,  $d_{xy}$  = the distance between the particle with mass  $m_x$  and that with mass  $m_y$ , and  $r_x$  = the radius of the particle with mass  $m_x$ . In other words, gravitational forces.

- Forces opposing the change in the state of movement of any elementary particle, which derive from the lateral relativistic Doppler effect on its interactions with zero-point radiation, and which are proportional to the product of the mass of the particle multiplied by the intensity of the change in its state of movement, i. e. by the acceleration

$$f_x = m_x a = m_x \left( \frac{\partial v}{\partial t} \right).$$

In other words, inertial forces.

- Forces deriving from the interaction of the rotation of elementary particles with a spin of  $\hbar/2$ , with zero-point radiation. In other words, electrostatic forces.
- Forces of weak interaction, deriving from the interaction of the rotation of elementary particles with zero-point radiation (still to be demonstrated).

- 3.2) Forces of interaction arise between nucleons within the atomic nucleus. These derive from the energy flows which arise to balance out the centrifugal and centripetal forces on the surface of the nucleons, whose radii are limited by the quantic threshold  $m_x r_x = e^2 c^{-2}$ .

We must consider, by comparison with the case of the electron, the curvature of the Universe which would be required to explain these forces; this could be the same curvature that Einstein suggested would be produced by the presence of masses within space.

### IV. BASIC CONSTANTS AT THE COSMOLOGICAL LEVEL (SEE [1])

- 4.1) The Hubble constant, which is the velocity in km/s per megaparsec of distance from Earth, at which cosmic objects move away, because of the expansion of the Universe.

$$\frac{60 \text{ km/s}}{\text{megaparsec}} < H_U < \frac{90 \text{ km/s}}{\text{megaparsec}};$$

$$1 \text{ megaparsec} = 3.26 \times 10^6 \text{ light-years.}$$

Improving the precision of our knowledge of the value of the Hubble constant is one of the most important challenges of cosmology at the start of the XXI century.

- 4.2) The age of the Universe,  $t_U$ . Assuming  $H_U = \frac{70 \text{ km/s}}{10^6 \text{ parsec}}$ , we calculate that  $1.397 \times 10^{10}$  years must have elapsed in order for there to exist luminous objects which move away from us at speeds near that of light, because of the expansion of the Universe.

The lack of precision in our knowledge of the value of the Hubble constant is accompanied by an analogous imprecision in our knowledge of  $t_U$ . Also, the value we have obtained is only a lower limit for  $t_U$ , since there could exist cosmic objects which have moved away from us at speeds greater than that of light, because of the Universe's expansion.

On the other hand, the age of the Universe would be less than what we have calculated here if it proved possible to see two images of a very distant cosmic object by looking in two diametrically opposed directions. See figures 2 in [2] and 3 in [2], as well as the related texts.

- 4.3) The relation between the length of the radius of the Universe,  $R_U = 1.39 \times 10^{10}$  light-years =  $3.819306 \times 10^{61} q_\lambda$ , and the wavelength of the photon possessing most energy in zero-point radiation  $x = 5.259601 \times 10^{27} q_\lambda$ ,  $k_U = R_U/x = 7.264351 \times 10^{33}$ .

- 4.4) The gravitational constant  $G$ , whose value in the  $(e, m_e, c)$  system is expressed as  $G = G_e \left( \frac{e}{m_e} \right)^2$ ,

where  $G_e = 2.399998 \times 10^{-43}$ . The value of  $G$  remains constant, and the variations in the numerical coefficient  $G_e$  are those which are required in order that  $G$  does not change, as wavelength  $x$  of the photon which possesses the greatest energy in zero-point radiation increases, in proportion to the increase in the radius of the Universe.

The expression  $G = \frac{(q_\lambda)^2 c^2}{2\pi^*}$  is invariant, as will be seen in 5.1, 5.2 and 5.4, since  $q_\lambda$ ,  $c$ , and  $*$  are invariant.

## V. BASIC CONSTANTS AT THE QUANTIC LEVEL (SEE [6])

- 5.1) The constant of the fine structure  $\alpha$ , which is the relation between the wavelength  $\lambda_E$  of the photon possessing an energy of  $E = hc/\lambda_E$ , and the radius of the fermions of mass  $E/c^2$ .
- 5.2) The velocity of electromagnetic radiation through empty space,  $c$ . The value of  $c$  is an upper limit which cannot be attained by fermions.

- 5.3) The quantum of wavelength of electromagnetic radiation,  $q_\lambda$ , whose measurement is  $q_\lambda = (2\pi\alpha)^{1/2} L_P$ , where  $L_P = \left( \frac{\hbar G}{c^3} \right)^{1/2}$  is the Planck length.

- 5.4) The basic quantum  $m_x r_x = e^2 c^{-2}$ , where  $m_x$  is the mass of a fermion and  $r_x$  is its radius. This quantum, to which we will here give the symbol  $*$ , is the necessary and sufficient condition for fermions to have a spin of  $\hbar/2$ .

- 5.5) There exist quanta for other magnitudes, i. e. minimal quantities, such that no smaller values could exist for them in physical reality, and that any quantity of the said magnitude must be expressible in whole numbers of those quanta. These other magnitudes are those which can be expressed as functions of  $c$  and  $*$ . They include the following:

- Electrical resistance  $(W_e) = c^{-1} = 3.335600 \times 10^{-11} \text{ s} \cdot \text{cm}^{-1}$ .
- Planck constant  $\hbar = \frac{2\pi}{\alpha} * \cdot c$ .
- Elementary charge  $e = (*)^{1/2} \cdot c$ .
- Flow of magnetic induction  $(\varphi_e) = (*)^{1/2}$ .
- Magnetic field  $(B_e) = (*)^{1/2} c^{-1}$ .
- Magnetic permeability  $(\mu) = c^{-2}$ .
- Momentum of rotation  $\hbar = \frac{*}{\alpha} c$ .

Where there is no symbol to designate the quantum, we have used that of the magnitude in question, placing it in brackets.

## REFERENCES

- [1] R. Alvargonzález and L. S. Soto: “Zero-point radiation and the Big-Bang”. *arXiv*: 0705.3722 VI [physics gen-ph], 25 May 2007.
- [2] R. Alvargonzález and L. S. Soto: “An analysis of the Big-Bang theory according to classical physics”. *arXiv-physics*/0408016.VI, 3 Aug 2004.
- [3] R. Alvargonzález: *Interactions between zero-point radiation and electrons*. *arxiv-physics*/0311139
- [4] R. Alvargonzález: “On the magnitude of the energy flow inherent in zero-point radiation”. *arXiv-physics*/0311027v2 [physics gen-ph] 17 Feb 2004.
- [5] R. Alvargonzález and L. S. Soto: “Zero-point radiation inertia and gravitation”. *arXiv-physics*/0312096v3 [physics gen-ph] 26 Jun 2007.
- [6] R. Alvargonzález and L. S. Soto: “Suggestions on Photons and on Fermions”. *arXiv*: 0705.3549 vI [physics. gen-ph] 24 May 2007.
- [7] M. J. Sparnaay: *Physica* 24, **751** (1958).
- [8] S. K. Lamoreaux: *Phys. Rev. Let.* 6, **78**, **5** (1997).
- [9] H. Boyer Timothy: *Phys. Rev.* **182**, p. 497 (1949).